

## **A new species of the genus *Geocharis* Ehlers, 1883 and some faunistic data on endogean carabids from Portugal (Coleoptera: Carabidae)**

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### **A new species of the genus *Geocharis* Ehlers, 1883 and some faunistic data on endogean carabids from Portugal (Coleoptera: Carabidae). -**

One endogean carabid of the genus *Geocharis* Ehlers, 1883 (Carabidae: Trechinae, Anillini) from Portugal, *Geocharis rodriguesi* n. sp., is described. The work provides diagnostic characters of this species, and in particular, the structure of male genitalia. Affinities with closely related species, as well as ecological and distribution comments are also included. A key for the identification of the males of the *Geocharis* species found North of the Tejo River in Portugal is given. Faunistic notes on endogean carabids from Portugal are also presented.

**Keywords:** Coleoptera - Carabidae - Trechinae - *Geocharis rodriguesi* n. sp. - Portugal - Iberian Peninsula.

## **INTRODUCTION**

The ground beetle subtribe Anillina have representatives occurring in many parts of the world, such as North and South America, Africa (especially Madagascar), Asia Minor, southern Asia, New Zealand and Mediterranean Europe (Sokolov *et al.*, 2004). The genera *Geocharis* Ehlers, 1883 and *Thyphlocharis* Dieck, 1869 belong to this subtribe and are very speciose in the Iberian Peninsula, with 28 and 46 species recognized, respectively, for this Peninsula, (Serrano, 2003; Serrano & Aguiar, 2004a, 2006a, 2006b, 2006c, in press; Serrano *et al.*, 2005; Zaballos, 2005; Andújar *et al.*, 2008). The knowledge of the systematics and distribution of *Geocharis* species from Portugal has notably increased over the last several years. There are seventeen species of *Geocharis* occurring in this Iberian country and, within this assemblage, four species are found exclusively at north of the Tejo River and thirteen at south of the same river (see Serrano & Aguiar, 2004a, 2006a).

The species of *Geocharis* are endogean, living in soil and can be found frequently on the bottom surface of the deeply imbedded stones. All species are eyeless (anophtalmous) and apterous. Many species seem very restricted in distribution (precinctive) (e.g., *G. portalegrensis* Serrano & Aguiar, 2000, *G. boieirol* Serrano & Aguiar, 2001), while others occur across large geographic areas (e.g., *G. femoralis* Coiffait, 1968, *G. coiffaiti* Serrano & Aguiar, 2006), both reflecting local and regional patterns of endemism.

This work provides descriptions of one new species of the genus *Geocharis* from Portugal. Moreover we provide a key to males of all known species of *Geocharis* found north of the Tejo River in Portugal and additional geographic distribution data for *G. olisipensis* Schatzmayr, 1937, *G. quartau* Serrano & Aguiar, 2004, *Typhlocharis paulinoi* Serrano & Aguiar, 2006 and *Hypotyphlus lusitanicus* Serrano & Aguiar, 2004.

## MATERIAL AND METHODS

Field work conducted in several regions of Portugal namely in some areas near the Cascais region and in the Serra de Montejunto (Province of Estremadura), Pedrógão Grande (Province of Beira Baixa), Serra de Monchique (Province of Algarve) and Ourique and Santa Margarida da Serra (Province of Baixo Alentejo), resulted in the collection of specimens of endogean beetle species of the subtribe Anillina. After a careful study, we concluded that the sampled specimens from Cascais region represent one new species to the science of the genus *Geocharis*. Part of the remaining specimens belong to two *Geocharis* species (*G. olisipensis* and *G. quartau*), one to the genus *Typhlocharis* (*T. paulinoi*) and one to the genus *Hypotyphlus* (*H. lusitanicus*). The specimens were direct hand collected under sunken stones in fragments of Mediterranean forest habitats dominated by holm-oaks, rock-roses shrubs and lentisk bushes (*Quercus coccifera* Linnaeus, *Cistus ladanifer* Linnaeus and *Pistacia lentiscus* Linnaeus, respectively). While in the Cascais region and in the Serra de Montejunto habitats the substrate is calcareous, in Pedrógão Grande, Serra de Monchique, Ourique and Santa Margarida da Serra the substrate is schistic. At all regions the clayey soils are of brown reddish colour. Additional specimens were obtained from samples of soil taken from the above-mentioned localities using Berlese apparatus.

The morphological study of adult specimens was done using a scanning electron microscope JEOL JSM-5200 LV. Measurements and drawings were done with a Wild M5 stereoscopic microscope equipped with a dissecting microscope ocular micrometer and a drawing tube. Cephalic chaetotaxy follows the terminology of Zaballos (2005).

The distribution of species in the descriptions is given in U.T.M. coordinates (1 km x 1 km). For practical reasons, the map used for the representation of distributions is of 10 km x 10 km squares (Fig. 11). Therefore some localities could be enclosed in the same 10 km x 10 km square.

## RESULTS

### *Geocharis rodriguezi* n. sp.

Figs 1-10

Type series. HOLOTYPE: Portugal, Alcabideche (Murches) (U.T.M. coordinates: 29SMC6288), 30.III.2006; PARATYPUS: same locality of Holotype, 30.III.2006, 1 ♂ 1 ♀; 7.IV.2006, 26 ♂ ♂, 9 ♀ ♀ (2 ♂ ♂, 2 ♀ ♀ gold coated), 23.XI.2007, 38 ♂ ♂, 32 ♀ ♀; Cascais (Malveira) (U.T.M. coordinates: 29SMC6188), 30.III.2006, 1 ♂. Holotype and 102 paratypes are deposited in the collection of the senior author, Department of Animal Biology (Faculdade de Ciências da Universidade de Lisboa). Six paratypes (3 ♂ ♂, 3 ♀ ♀) are deposited in the collection of the Muséum d'histoire naturelle Genève, Switzerland.

*Diagnosis:* Anophtalmous; body slightly depressed, brown with integument microreticulate. A sparse pubescence mainly on pronotum and elytra. Elytron without striae, only humeral region punctured, disk with one anterior seta and a posterior one. Male forelegs with the first tarsomere dilated. Males with a more or less developed median tooth on the internal margin of the metafemora, females without or with a very slight tooth. Mesotibiae with dense pubescence in both margins. Hind tibiae more or less right. Aedeagus as in Figs 9-10.

*Description:* Length of holotype: 2.0 mm. Length of paratypes: 1.9-2.3 mm (males and females). Head (Fig. 1) more or less as long as wide [length: 0.34-0.48 mm (males), 0.34-0.42 mm (females); width: 0.43-0.48 (males), 0.38-0.45 mm (females)], microsculpture distinct. Cephalic chaetotaxy (fixed setae of left side): F3+C1+F1+SA1+SP1+V1+O1+P1+G2. Antennae light brown, the 1st and 2nd articles longer than the others, the latter subpyriform, the 3rd and the 4th are the shortest ones and subpyriforms, the 5th to the 10th gradually longer and oval-shaped, the last one acuminate. Mouth-parts (Fig. 2) show the general pattern of the genus.

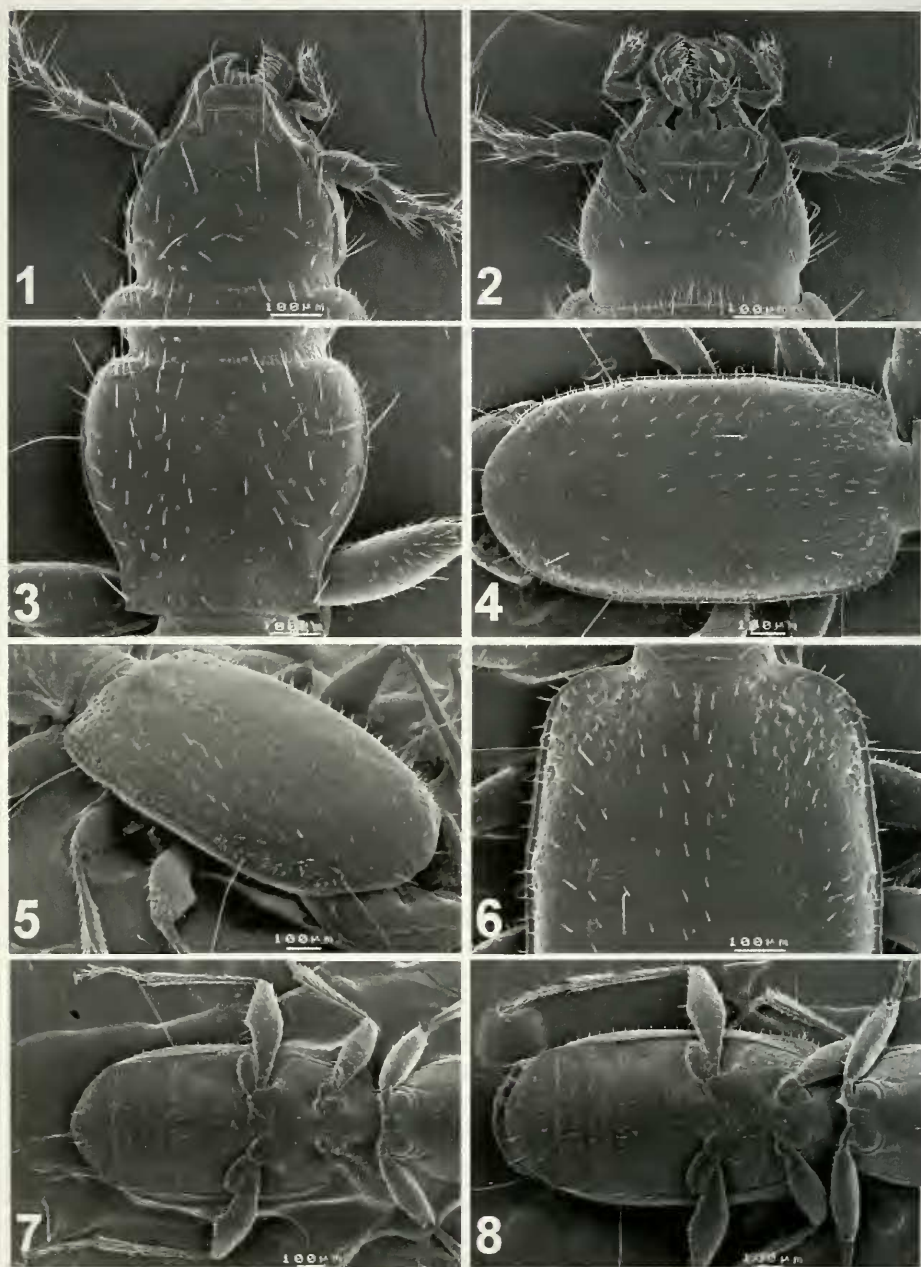
Pronotum cordiform (Fig. 3) with round anterior angles, about 1.2 times wider than long [length: 0.43-0.52 mm (males), 0.42-0.48 mm (females); width: 0.49-0.61 mm (males), 0.50-0.56 mm (females); disk slightly convex, depressed between the two basal pits, with a superficial central sulcus which do not reach the anterior margin; this margin and posterior margin slightly arcuate (Fig. 3); lateral margins with 3 or 4 denticles just before the posterior angles, which are right and dentate; Vestiture (pubescence): surface covered with scattered erect pubescence; one seta on the lateral margin in the broadest part of the pronotum, another one near the posterior angle; 2 additional setae inserted near the anterior angles.

Elytra (Fig. 4) 1.7-1.8 times longer than wide [length: 1.09-1.31 mm (males), 1.09-1.22 mm (females), width: 0.62-0.74 mm (males), 0.61-0.72 mm (females)], slightly convex, subparallel and oval posteriorly; the tegument microsculptured and just punctured in the shoulders (Fig. 6); disk without striae; lateral margin narrow, finely serrate from the humeral angles, which are rounded, to the 5th seta of the umbilicate series. Vestiture (pubescence): part of the pubescence of the disk is arranged in 5-6 irregular lines, these setae are erect and slightly directed antieriad (Figs 4-5); umbilicate series follows the pattern of the genus. The longest setae of this series are the 2nd, the 6th and the 9th with the 3rd, 5th, 7th and 8th, more slightly inserted within the elytral margin; besides these setae there are 1 parascutellar basad, 2 discal (1 anterior and 1 posterior) and 1 apical seta (Figs 4- 5).

Male legs with the 1st protarsomere dilated; 1st tarsomere in all legs more pigmented (light brown) than the others; mesotibiae with a strong pubescence on both margins; hind femora (males) with a more or less strong median tooth on the internal margin (Fig. 7), females without or with a very slight tooth (Fig. 8).

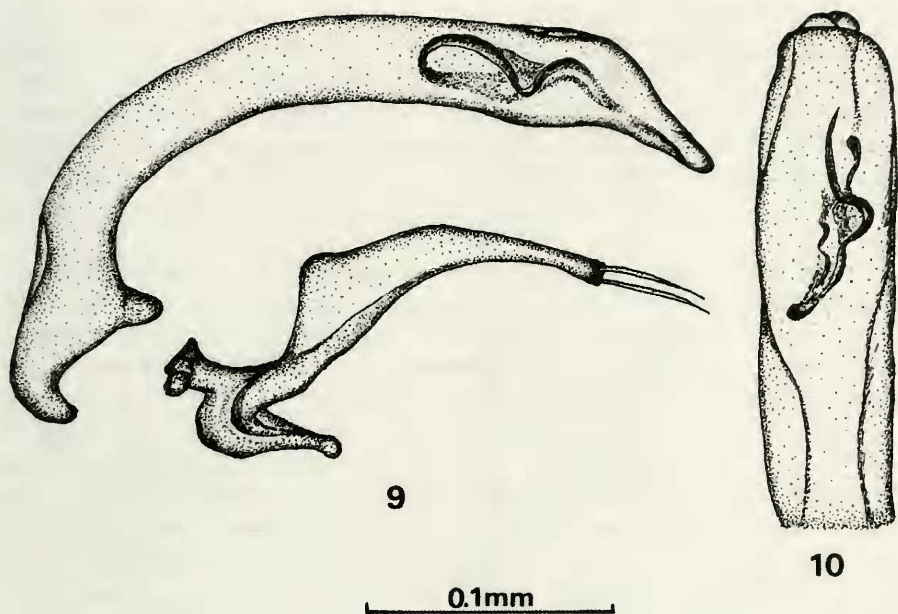
Male genitalia (Figs 9-10) with median lobe strongly arcuate, slightly enlarged in the basal margin before the apex (lateral view), apex broadly sharp and slightly bent down, basal lobe with apophysis prominent; internal sac as in figures 9-10; left and right parameres with 2 apical setae, left paramere with dorso-basal edge slightly expanded (Fig. 9).





FIGS 1-8

*Geocharis rodriguesi* n. sp. (1) Head (dorsal view). (2) Head (ventral view). (3) Pronotum (dorsal view). (4) Elytra (dorsal view). (5) Left elytron (latero-dorsal view). (6) Anterior half of elytra (dorsal view). (7) Thorax and abdomen (male, ventral view). (8) Thorax and abdomen (female, ventral view).



FIGS 9-10

Aedeagus of *Geocharis rodriguesi* n.sp. (9) Median lobe and left paramere in lateral view. (10) Apex of median lobe in dorsal view.

The female genitalia general pattern as for the other species of the genus (e.g., Zaballos & Jeanne 1987; Zaballos 1998; Zaballos, 2005). Female genitalia (not shown) with gonocoxite IX sickle-shaped, a long ensiform seta in the middle region of the external margin, one ensiform seta in the middle dorsal region and a double nematiform seta in the internal margin near the beginning of the apical third. Gonosubcoxite IX without special features; laterotergite IX with a variable number of setae (more or less 20). Internal genitalia with a subspherical spermatheca, duct of spermathecal gland short, gland fusiform, middle region membranous, apical portion sclerotized.

*Etymology*: This new species is dedicated to Professor Pedro Rodrigues, who has greatly contributed to the taxonomic knowledge of the Heteroptera Tingidae, mainly of Afrotropical Region and Portugal, and become a remarkable academic reference to the senior author.

#### MORPHOLOGICAL AFFINITIES

*Geocharis rodriguesi* n. sp. is akin to most species of *Geocharis* by the possession on the elytral disk of two setae, one anterior and one posterior. Some other species of *Geocharis* present a different number and/or localization of these discal setae which are: *G. cordubensis* (Dieck, 1869) and *G. rotundata* Serrano & Aguiar, 2006 (three pairs of setae: one anterior, one median and a posterior one) and *G. olisipensis* Schatzmayr, *G. falcipenis* Zaballos & Jeanne, 1987 and *G. ruiiztapiadori* Zaballos, 1996 (one or two pairs of setae: A posterior one only, or both a median and a posterior ones).

The new species presents a tooth on the internal margin of the hind femora of males such as many other of the genus (*Geocharis leoni* Zaballo, 1998, *G. cordubensis*, *G. femoralis* Coiffait, *G. grandolensis* Serrano & Aguiar, 2000, *G. portalegrensis* Serrano & Aguiar, *G. saldanhai* Serrano & Aguiar, 2000, *G. boiei* Serrano & Aguiar, *G. estremoensis* Serrano & Aguiar, 2003, *G. sacarraoi* Serrano & Aguiar, 2003, *G. fermini* Serrano & Aguiar, 2004, *G. quartai* Serrano & Aguiar, 2004, *Geocharis juncoi* Zaballo, 2005, *G. coiffaiti* Serrano & Aguiar, 2006 and *G. rotundata*).

*Geocharis rodriguesi* n. sp and *G. iborensis* Zaballo, 1990 present a general conformation (lateral view) of median lobe very similar. However, other features like different armature pattern of the internal sac and left paramere and pronotum conformations easily segregate both species. Moreover the males of *G. iborensis* do not present a tooth on the internal margin of the hind femora. Taking into account the more or less sickle-shaped pattern of median lobe, the new species seems also close to *G. olisipensis* and *G. leoni*. However, in the former species the internal edge of male hind femora is inerm. The new species differ from *G. leoni*, among other features, also by characters of the left paramere, which does not bear any lamellar and membranous scales in the apex (Zaballo, 1998). Adults of the new species described herein lack traces of striae on elytra unlike *G. quartai*, *G. massinissa* (Dieck, 1869), *G. korbi* (Ganglbauer, 1900), *G. julianae* Zaballo, 1989 and *G. montecristoi* Zaballo 2005.

Finally, we can point out that the new species is easily separated from the others of the same genus by the shape of median lobe and the sclerites of the internal sac. The conjugation of aedeagus features plus some characters such as the left paramere and pronotum forms, the elytral microsculpture and the tooth of male hind femora (present) can help in his diagnosis.

#### FAUNISTIC DATA

##### *Geocharis olisipensis* Schatzmayr, 1937

Material examined: Serra de Montejunto (U.T.M. coordinates: 29SMD9737), 25.X.2005, 1♂, 3 ♀♀, 24.XI.2005, 2♂♂, 2♀♀.

Within the genus *Geocharis* this species was the first one described for Portugal (Schatzmayr, 1937) based on two specimens collected near Lisbon. Serrano & Aguiar (2004) after some efforts to locate this species found it in the outskirts of Lisbon (Valejas and Fanhões). The study of some specimens captured in Serra de Montejunto (almost 50 km to north of Lisbon), showed for this species a wider distribution than previously knew (Fig. 11).

##### *Geocharis quartai* Serrano & Aguiar, 2004

Material examined: Serra de Montejunto (U.T.M. coordinates: 29SMD9737), 25.X.2005, 1♂, 24.XI.2005, 1♂, 1♀.

A species recently described on the basis of several specimens collected near Alcobaça (Carvalhal), a locality close to Aire e Candeeiros Mountains. As well as the precedent species, the study of some specimens captured in Serra de Montejunto (almost 40 km to south of Alcobaça), showed for this species a wider distribution than previously knew. These captures showed that these two species are syntopic, at least for the Montejunto region (Fig. 11).

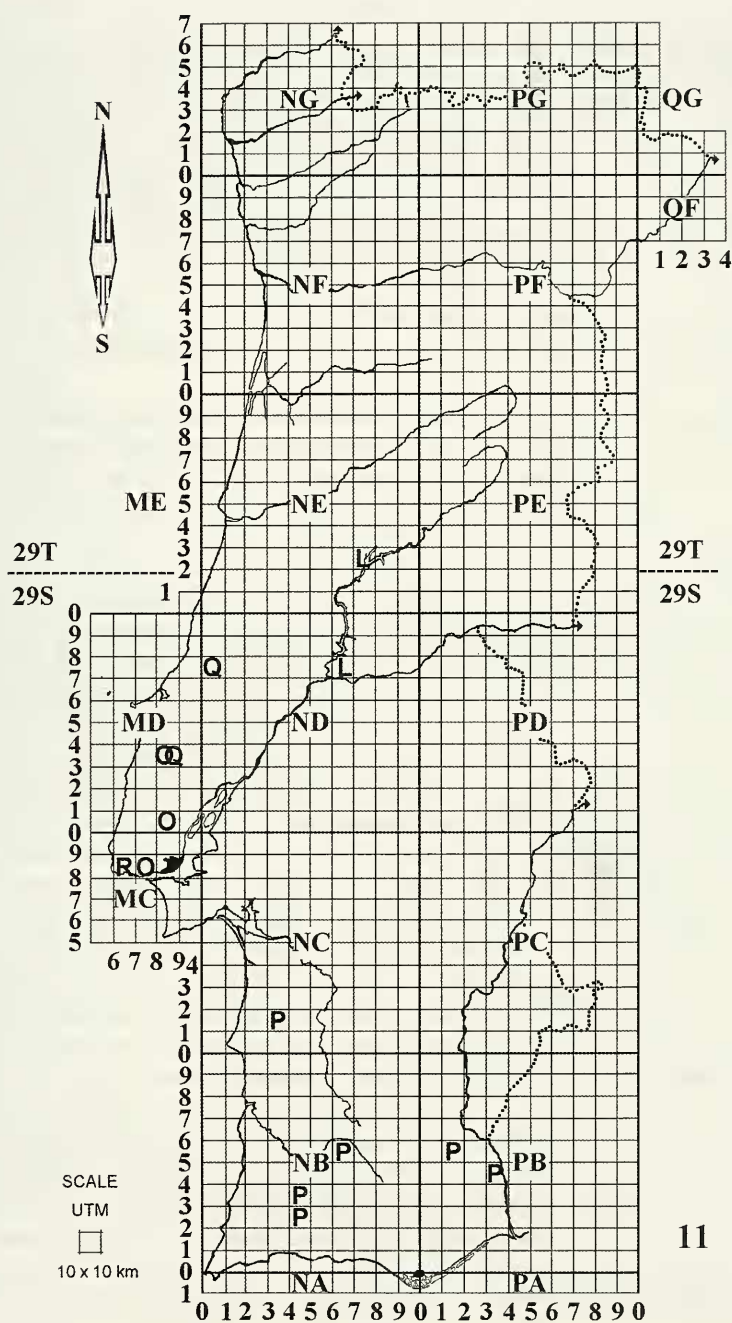


FIG. 11

Distribution in Portugal (U.T.M. 10x10 km coordinates): (R) *G. rodriguesi* n. sp., (O) *G. olisipensis*, (Q) *G. quartai*, (P) *T. paulinoi* and (L) *H. lusitanicus*.



*Typhlocharis paulinoi* Serrano & Aguiar, 2006

Material examined: Fernão Vaz (U.T.M. coordinates: 29SNB6459), 31.I.2006, 7♂♂, 6♀♀; Altura da Choça (U.T.M. coordinates: 29SNB4732), 22♂♂, 7♀♀; Santa Margarida da Serra (U.T.M. coordinates: 29SNC3515), 14.III.2006, 11♂♂, 8♀♀, 3.IV.2006, 1♀.

Another species recently described to southern regions of Portugal (Algarve Province) (Serrano & Aguiar, 2006b). While the former localities (Fernão Vaz and Altura da Choça) are more or less close to the ones already given (Serrano & Aguiar, *op. cit.*), the latter (Santa Margarida da Serra) showed for this species a wider distribution to north (almost 80 km) than previously tough (Fig. 11).

*Hypotyphlus lusitanicus* Serrano & Aguiar, 2004

Material examined: Barragem do Cabril (Pedrógão Grande) (U.T.M. coordinates: 29SNE7321), 20.III.2007, 3♀♀.

This remarkable species was found in the centre of Portugal (Aldeia do Mato near Tomar) (Serrano & Aguiar, 2004b). The new locality here given increases considerably the distribution of this species almost far away 60 km to north (Fig. 11).

## ECOLOGICAL AND GEOGRAPHICAL CONSIDERATIONS

The new species are endogean, like the others of the genus *Geocharis*, living in the soil at different depths of the B-horizon. Normally, only one species of *Geocharis* occurs at any one locality, however, there are some observed exceptions (see above and Serrano & Aguiar, 2006a). *Geocharis rodriguesi* n. sp. is also syntopic with one new species of the genus *Typhlocharis* (not given here, Serrano & Aguiar, in press).

All the *Geocharis* species herein studied are known from localities that range between the Lisbon region and Aire e Candeeiros Mountains. Curiously despite several field surveys to north of Tejo river at Portugal, only the ones conducted in the western region north of Lisbon allowed the discovery of *Geocharis* species until now. Furthermore, in this region those surveys allowed us also to find and describe two species of the genus *Typhlocharis* (*T. passosi* Serrano & Aguiar, 2005, and *T. bivari* Serrano & Aguiar, 2006), all belonging to the *gomezi* group (Serrano *et al.*, 2005, 2006c). On other regions north of Tejo river at Portugal than the above we found and described one species of *Typhlocharis* near Vila Nova de Foz Côa (*T. fozcoensis* Serrano & Aguiar, 2005) and one species of the genus *Hypotyphlus* (*H. lusitanicus*) near Castelo de Bode dam (Aldeia do Mato, Tomar). Recently we found the latter species at Cabril dam near Pedrógão Grande, a station almost 60 km to north of the previously recorded locality. The precise distribution limits of all these species are difficult to address with no additional data available. Our studies during the last five years confirm that the previous idea that the majority of endogean carabid species are restricted in distribution is not totally certain. For instance the finding of *T. paulinoi* about 80 km far away of his known distribution is a good example of this assumption. Finally we would like point out that *G. rodriguesi* n. sp. was found within the limits of the Parque Natural Sintra-Cascais, a protected area in Portugal included in the "Rede Natura 2000".



KEY TO SPECIES OF *GEOCHARIS* NORTH OF TEJO RIVER (PORTUGAL)

1. Disk of elytra with one or two pairs of setae, one posterior or one median and one posterior. Internal edge of male hind femora inerm. Aedeagus as in figure 26 C and D (in Serrano & Aguiar, 2004a) . . . . . *G. olisipensis*
- 1'. Disk of elytra with two pairs of setae, one anterior and one posterior. Internal edge of male hind femora inerm or dentate . . . . . 2
2. Internal edge of male hind femora inerm. Elytra with tegument strongly punctured in the disk, without striae. Aedeagus as in figure 26 A and B (in Serrano & Aguiar, 2004a) . . . . . *G. quartau*
- 2'. Internal edge of male hind femora dentate . . . . . 3
3. Elytra with tegument only punctured near the shoulders, the disk without striae . . . . . 4
- 3'. Elytra with tegument strongly punctured in the disk, with the presence of superficial striae. Aedeagus as in figure 17 C and D (in Serrano & Aguiar, 2004a) . . . . . *G. bivari*
4. Aedeagus as in figure 17 A and B (in Serrano & Aguiar, 2004a) . . . *G. fermini*
- 4'. Aedeagus as in figure 9 and 10 (this work) . . . . . *G. rodriguesi* n. sp.

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## REFERENCES

- ANDÚJAR, C., LENCINA, J. L. & SERRANO, J. 2008. *Typhlocharis* Dieck, 1869 (Coleoptera, Carabidae, Anillini): a new species from the Iberian Peninsula, with notes about its relationships and the evolution of the diecki species group. *Zootaxa* 1842: 35-44.
- SCHATZMAYR, A. 1937. Due nuovi Bembidiini anoftalmi della Regione Palearctica. *Pubblicazione del Museo Entomologico "Pietro Rossi" Duino* 1: 327-328.
- SERRANO, J. 2003. Catálogo de los Carabidae (Coleoptera) de la Península Ibérica. *Monografías S.E.A.* 9: 5-130.
- SERRANO, A. R. M. & AGUIAR, C. A. S. 2004a. Three new species of the genus *Geocharis* Ehlers, 1883 from Portugal (Coleoptera, Carabidae). *Graellsia* 60 (1): 71-80.
- SERRANO, A. R. M. & AGUIAR, C. A. S. 2004b. A remarkable new endogean species of the genus *Hypotyphlus* Jeannel (Coleoptera: Carabidae) from Portugal. *The Coleopterists Bulletin* 58 (1): 111-117.
- SERRANO, A. R. M. & AGUIAR, C. A. S. 2006a. New species and new data on the genus *Geocharis* Ehlers, 1883 (Coleoptera: Carabidae) from Portugal. *Annales de la Société entomologique de France* (n.s.) 42 (1): 79-89.
- SERRANO, A. R. M. & AGUIAR, C. A. S. 2006b. Two new species of *Typhlocharis* Dieck, 1869 of the *silvanoides* group from Portugal (Coleoptera, Carabidae). *Animal Biodiversity and Conservation* 29 (1): 9-18.
- SERRANO, A. R. M. & AGUIAR, C. A. S. 2006c. Two new species of *Typhlocharis* Dieck, 1869 (Coleoptera, Carabidae) from Portugal and notes on the related species. *Deutsche entomologische Zeitschrift* 53 (2): 223-234.
- SERRANO, A. R. M. & AGUIAR, C. A. S. in press. Two new species of *Typhlocharis* Dieck, 1869 (Coleoptera: Carabidae) from Portugal: description and notes on the related species. *Graellsia*.

- SERRANO, A. R. M., AGUIAR, C. A. S. & PROENÇA, S. J. R. 2005. Two new species of *Typhlocharis* Dieck of the gomezi species group from Portugal (Coleoptera: Carabidae). *The Coleopterists Bulletin* 59 (2): 239-249.
- SOKOLOV, I., CARLTON, C. & CORNELL, J. F. 2004. Review of *Anillinus*, with descriptions of 17 new species and a key to soil and litter species (Coleoptera: Carabidae: Trechinae: Bembidiini). *The Coleopterists Bulletin* 58 (2): 185-233.
- ZABALLOS, J. P. 1998. Interesante nueva especie de *Geocharis* Ehlers, 1883 de España (Coleoptera, Caraboidea, Trechidae, Anillini). *Graellsia* 54: 19-24.
- ZABALLOS, J. P. 2005. Los *Geocharis* Ehlers, 1883 de Marruecos y Cádiz (España) (Coleoptera, Carabidae, Trechinae, Anillini). *Graellsia* 61 (1): 61-81.
- ZABALLOS, J. P. & JEANNE, C., 1987. Etude systématique du genre *Geocharis* (Col. Trechidae Anillini) et description d'une nouvelle espèce. *Bulletin de la Société linnéenne de Bordeaux* 15 (2): 81-92.